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GB/T 7184-2023

Reciprocating internal combustion engines - Evaluation method of vibration

往复式内燃机 振动评定方法

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Foreword

This document was issued on 7 September 2023 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 April 2024.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 7184-2023 covers how the vibration of a complete reciprocating internal combustion engine is measured and judged, taken on the parts that neither rotate nor reciprocate - the measuring instruments, including what the sensors and the cabling between them and the analyser have to meet; the working conditions under which readings are valid; the measurement of vibration intensity; the records that must accompany each reading; and the way a vibration severity level is derived from them. Clause 5 turns that severity level into an assessment, Annex A carries the evaluation itself as a normative annex, and Annex B describes the kinds of vibration a reciprocating engine generates. Every such engine shakes by design, since the gas forces and the reciprocating masses cannot be balanced

away; what matters is whether it shakes more than the mounts, the foundation, the attached pipework and the people nearby can take, and whether a rise over time is a warning. Unless the sensor position, the running condition and the way readings are averaged are fixed in advance, a figure from one builder cannot be compared with another's or with a contractual limit. Written for engine manufacturers, genset and marine propulsion integrators, and the inspection bodies that accept them.

This document describes the method for vibration evaluation of non-rotating and non-reciprocating components of complete reciprocating internal combustion engines.

This document applies to reciprocating internal combustion engines defined in GB/T 21404 (hereinafter referred to as "engines" unless otherwise specified), as well as other internal combustion engines for which no appropriate standards are available.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 2298, Mechanical vibration, shock and condition monitoring -- Vocabulary

GB/T 6072.1, Reciprocating internal combustion engines -- Performance -- Part 1: Declarations of power, fuel and lubricating oil consumptions and test methods -- Additional requirements for engines for general use

GB/T 6072.3, Reciprocating internal combustion engines -- Performance -- Part 3: Test measurements

GB/T 13824, Mechanical vibration of rotating and reciprocating machinery -- Requirements for instruments for measuring vibration severity

GB/T 14412, Mechanical vibration and shock -- Mechanical mounting of accelerometers

GB/T 14777, Geometrical orientation and directions of movements

GB/T 21404, Internal combustion engines -- Determination and method for the measurement of engine power -- General requirements

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 2298, GB/T 6072.1 and GB/T 14777 as well as the followings apply.

3.1 vibration severity

A value or a group of values such as a maximum value, average value, RMS value, or other value describing a vibration parameter, involving multiple transient values or multiple average values.

NOTE: Vibration severity is a general term that was often used in the past when referring to vibration velocity, but is now also used for displacement and acceleration, etc.

[Source: GB/T 2298-2010, 3.51, modified]

4 Measurement methods

4.1 Measuring instruments

4.1.1 General

The measurement system including sensors and cables shall meet the requirements of GB/T 13824.

If the measurement system cannot fully meet the requirements of GB/T 13824, but the measurement results can meet the requirements of GB/T 13824, then the measurement system can be considered as an equivalent measurement system that meets the requirements of GB/T 13824.

4.1.2 Calibration

Unless otherwise specified by national regulations, the calibration cycle of the measurement system, including sensors and cables, is 1 year.

4.2 Working conditions

4.2.1 General

The installation and operating conditions of the engine have an impact on the working state of the object being measured. This document specifies the installation conditions and operating conditions that minimize the changes in engine vibration during bench measurements. Field measurements are performed according to actual installation conditions and operating conditions.

4.2.2 Installation conditions

When measuring on a bench, the engine shall be installed on a base as close to the actual usage as possible and elastically connected to the dynamometer.

4.2.3 Operating conditions

During bench measurement, the engine shall operate stably according to the ISO standard power and corresponding speed specified in GB/T 6072.1. The engine oil temperature and coolant temperature must be stable.

Fixed speed engines are operated at rated conditions. Engines for other purposes are generally operated at full load speed characteristics (i.e. external characteristics) or propeller propulsion characteristics (such as marine main engines) or traction characteristics (such as locomotive diesel engines).

When the external characteristic, propeller propulsion characteristic or traction characteristic is running, the dynamic measurement of speed increase/deceleration is preferred, and steady-state measurement is also possible. The operating conditions shall include the rated speed condition and the minimum operating speed condition. The speed interval of the operating condition is calculated from the rated speed. The minimum operating speed condition is usually determined by the external characteristic curve provided by the manufacturer. When the speed increase/deceleration is measured dynamically, the speed interval is 25 r/min, and the speed change rate shall be less than or equal to 75 r·min-1/s. When the steady-state measurement is performed, the speed interval is selected according to the 100 r/min, 50 r/min, and 25 r/min numerical system. If necessary, measurements can also be taken and recorded under other operating conditions or other speed intervals.

The measurement of engine power and corresponding speed shall be carried out in accordance with the provisions of GB/T 6072.3.

4.3 Measurement of vibration intensity

4.3.1 General

The vibration severity in this document is described by the root mean square value. The